

Exploration of UHPC Applications for Montana Bridges

Project Kickoff Meeting Minutes

August 19, 2021, 2:00-3:30 pm (Mountain time)

Zoom Meeting

Attendees:

Mike Berry- MSU Faculty

Paul Bushnell- MDT Materials Bureau

Vaneza Callejas- CTC, Main Point of Contact, meeting host

Meghan Coon- MDT Bridge Bureau

Wes Dess- MDT Materials Bureau

Nathan Haddick- MDT Bridge Bureau

Lenci Kappes- MDT Bridge Bureau

Kirsten Matteson- MSU Faculty

Oak Metcalfe- MDT Materials Bureau

Jin Nelson- MDT Bridge Bureau

Matt Needham- MDT Materials Bureau

Drew Sielbach- FHWA Structures Engineer

James Starke- MSU Grad Student

Tyler Steffan- Bridge Design Engineer

Vaneza introduces everyone

Opens up Meeting

Kirsten gives Presentation (slides attached)

UHPC Phases of Research and project background

Implementation Updates on Wisdom Bridges, delayed by fire but scheduled to be built weeks of August 23rd and September 13th

Project Scope

- Literature Review
- Material Level Evaluation
- Intermediate Technical Panel Meeting
- Experimental Design and Structural Testing
- Structural Testing
- Analysis of Results and Reporting

Literature Review- Mix Design Alterations for overlays, standard overlay thickness, surface preparation, bond potential, chloride effects, cracking potential

Material Level Evaluation- Investigate Feasibility of Stiffer Mix, direct tension testing, slant shear testing, flexural testing

Intermediate Technical Panel Meeting- Discuss task 1 and 2, decide focus of task 3 and 4, current focus is overlays and patching

Experimental Design and Structural Testing- Overlays: Flexural Testing, bond strength, effect of temperature gradient, punching shear, implementation, and preparation issues. Patching:

Repairing the ends of steel girders, bond strength.

Structural Testing- Carryout tasks from task 3.

Analysis of Results and Reporting- Gave all deliverables

Presented Project schedule- next technical panel meeting on May 16

Open Discussion and Questions

Lenci Kappes: Mentioned how there are many applications for UHPC out there and these tasks seem like the right direction. We'll learn a lot in Wisdom and see where to go from here.

Drew Sielbach: Mentioned Every Day Counts (EDC) initiative, can be hosted in Montana and allows local contractors to learn what's new in UHPC.

Lenci Kappes: It has been considered but they are not sure on a decision yet.

Tyler Steffan: Very interested in trying to also get larger batch sizes for feasibility, do we need to get more or a bigger mix to get the material needed for an overlay. How will temperature effect mix. EDC may help with this as well.

Kirsten Matteson: It has been used previously so we will definitely look into it.

Oak Metcalfe: Mentioned that he had talked with Stephanie who had heard from a lot of salesman for other UHPC.

Lenci Kappes: Non-proprietary isn't always required for the future. It is good for saving money, but there are other materials and tools for other applications. EDC could help introduce more topics.

Tyler Steffan: Also, had received phone call from UHPC company. It is not impossible for us to use a proprietary UHPC mix but it will vary by project.

Lenci Kappes: On the Yellowstone project, the contractor had mentioned they could do the Wisdom bridges at a cost savings.

Mike Berry: It is mentioned in the proposal that other mix designs are also options. The literature review should help weed this out. Some DOT's have specified non-proprietary mixes and the contractor has come back asking to use a proprietary mix for less liability.

Jin Nelson: Was on a project in 2012 using UHPC for precast joints, the mix wasn't grinded soon enough which led to issues.

Lenci Kappes: UHPC often hasn't been used because it isn't written in any codes. This research should help fill those gaps for future uses. Could even be applied to proprietary mixes.

Drew Sielbach: Is there anyone here from a construction side.

Lenci Kappes: No, but we have reached out to them. Many were busy this summer but could be added to the technical panel for the next meeting. Our second meeting could also help shift the research if needed to see what we prioritize if overlays become too difficult.

Tyler Steffan: Some of the Butte construction guys might be able to sit in on the meetings this winter.

Lenci Kappes: On timber bridge replacements with longitudinal joints, it just makes sense to use UHPC to add the strengths. Would definitely help with maintenance.

Vaneza Callejas: Made a note to see if anyone needs to be added to meeting list in May 2022.

Lenci Kappes: Fred B, Paul Bushnell, and Tyler Baumberger mentioned some guys from Dick Anderson would be interested in joining in as well. A good part of this research is getting contractors familiar with the materials. Anyone is also welcome to come down to Wisdom to see the bridges going in.

Mike Berry: The exact times for the bridges going in slightly open. Depends on cure times which will be determined using a maturity meter.

No final comments, everyone excited to see where the project goes.

Exploration of MT-UHPC Applications for Montana Bridges



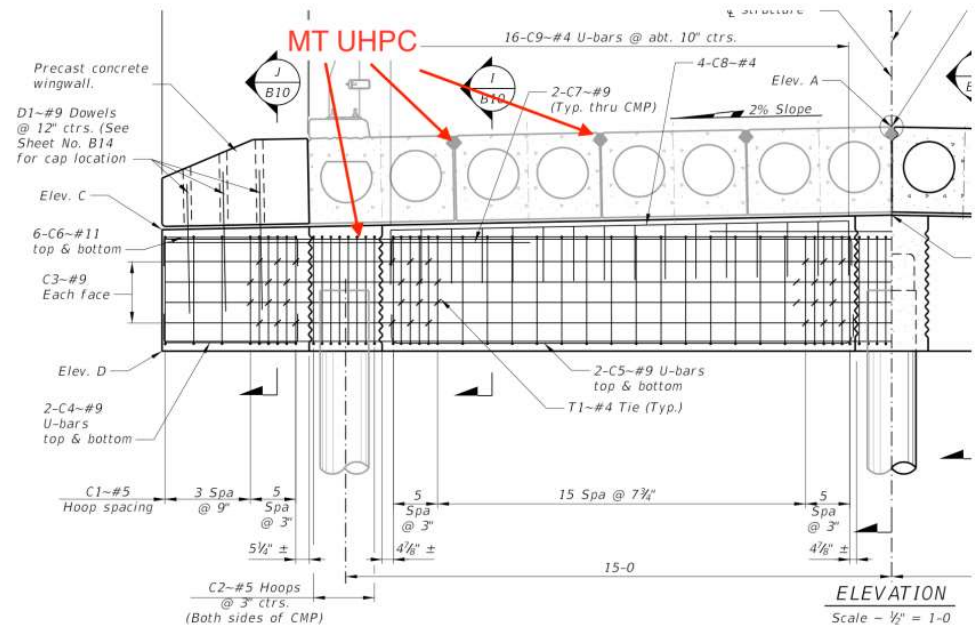
Kirsten Matteson, PhD
Michael Berry, PhD
James Starke, GRA

UHPC Project Background

- Phase 1 – Feasibility
 - We can make UHPC with materials readily available in Montana
- Phase 2 – Field Application and Sensitivity Study
 - Changes in constituent materials and batch size
 - Bonding properties and pull-out strengths
- Phase 3 – Implementation
 - Concurrent research on the first use of MT-UHPC for field cast joints
 - Investigate constructability issues that may hinder use of MT-UHPC in future applications

Implementation Updates

- Trail Creek Bridges on Highway 43 West of Wisdom
 - Precast pile cap joints
 - Shear keys between precast deck elements
- Bridge 1 Aug 23rd
- Bridge 2 Sept 13th



Applications Project Scope

Task 1 – Literature Review

Task 2 – Material-Level Evaluation

Intermediate Technical Panel Meeting

Task 3 – Experimental Design of Structural Testing

Task 4 – Structural Testing

Task 5 – Analysis of Results and Reporting

Task 1 - Literature Review

We will perform a review of recent research related to the use of UHPC on bridge applications. Some specific topics include:

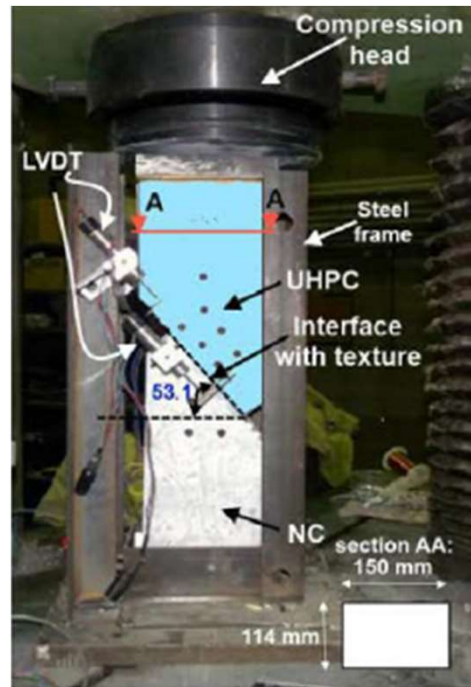
- Mix design alterations to yield a stiffer mix
- Standard overlay thicknesses
- Underlying concrete surface preparation methods for UHPC overlays
- UHPC bond potential with weak/deteriorating underlying concrete
- The effects that chlorides and pH may have on the bond strength between deteriorating concrete and UHPC
- Cracking potential for overlays (crack propagation from the underlying concrete)

Task 2 – Material-Level Evaluation

- Investigate feasibility of stiffer mixes for potential overlay application.
- Direct Tension Testing
- Slant Shear Testing
- Flexural Testing



Massicotte et al.



Wibowo et al.

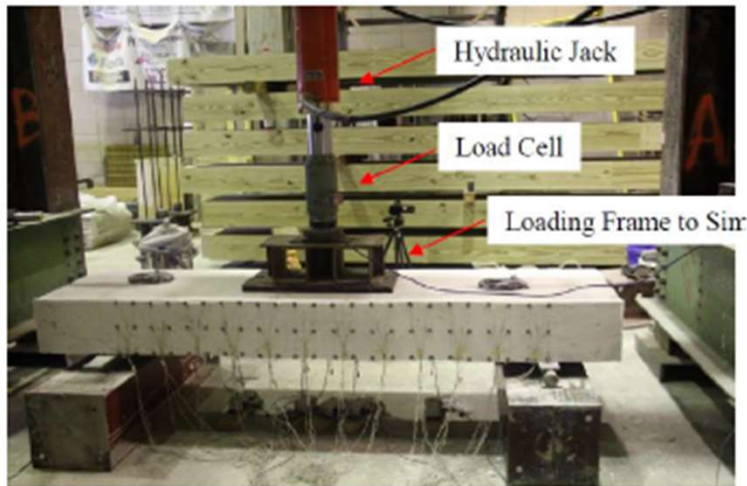


Intermediate Technical Panel Meeting

- Discuss findings of Tasks 1 and 2
- Decide focus and direction of the structural testing, Tasks 3 and 4
- Currently, we foresee overlays and patching/repairing deteriorating members being of primary interest

Task 3 – Experimental Design of Structural Testing

- Potential areas of interest for overlay specimens
 - Flexural capacity
 - Bond between slab and overlay
 - Effect of temperature gradient on bond
 - Punching shear
 - Implementation/preparation issues – formwork methods, finishing/consolidation techniques, etc..



a) Test setup



b) Partial overlay debonding following shear failure

Wibowo et al.



Task 3 – Experimental Design of Structural Testing

- Potential areas of interest for patching/repairing specimens
 - UHPC has been investigated as a repair method to rehabilitate damaged flexural members, steel girders, and columns.
 - Repairing steel girder ends with UHPC



a) Typical end corrosion of bridge girders



b) Installation of shear studs for UHPC repair

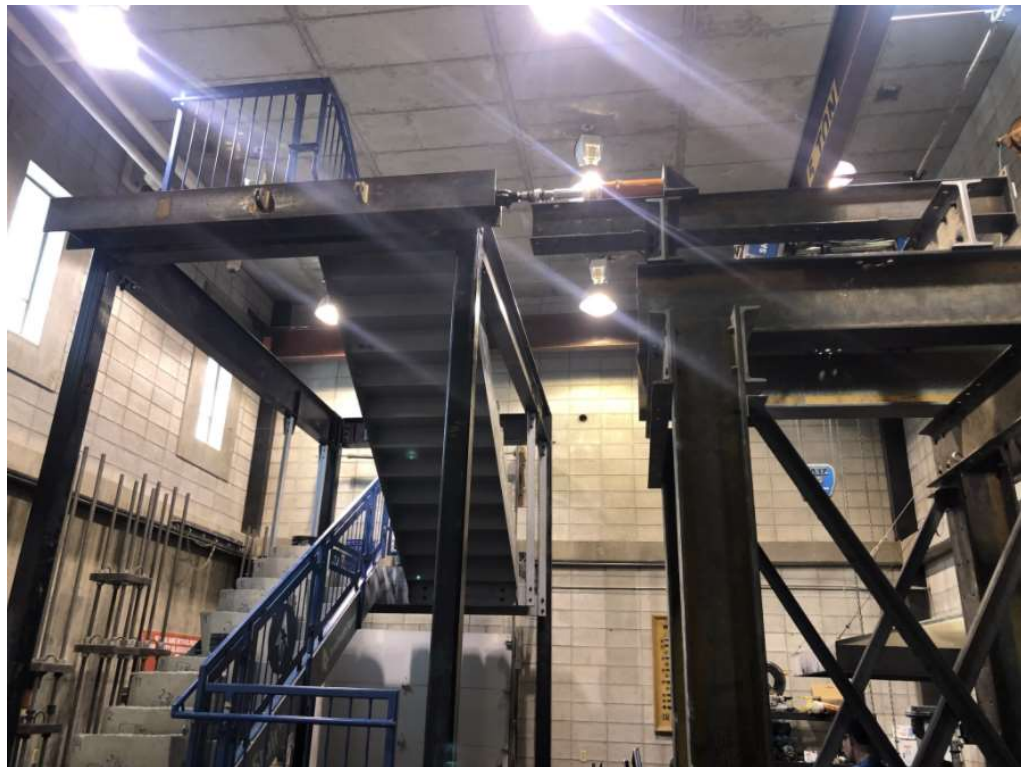
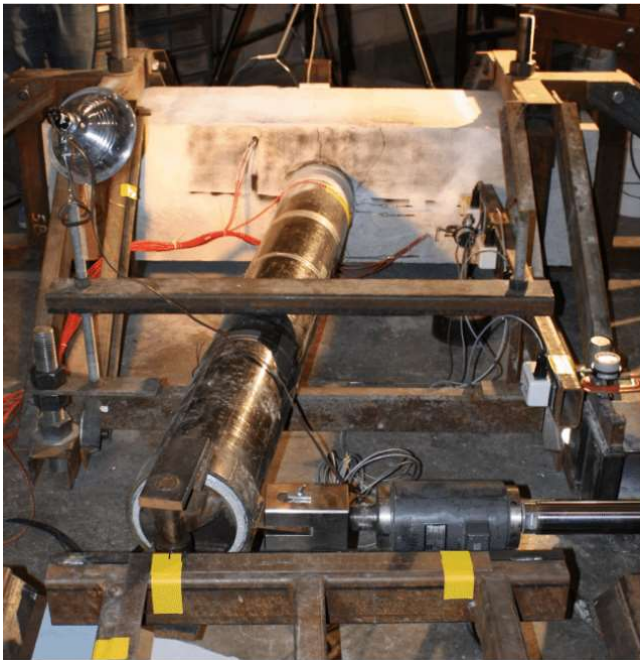


c) Example finished repair

Zaghi et al.

Task 4 – Structural Testing

- Carryout the test series determined in Task 3



Task 5 – Analysis of Results and Reporting

Deliverables

- Kick-off meeting and subsequent notes.
- 7 quarterly progress reports.
- **4-task reports** (Tasks 1-4).
- **Draft final report** and executive summary describing the research methodology, findings, conclusions, and recommendations, followed by a **final report** addressing comments and suggestions from the Technical Panel.
- Final presentation and webinar.
- Project summary report.
- **Implementation report**, meeting, and material specifications.
- Performance measures report.
- Project Poster.

Project Schedule

Activities	Dates	Project Quarter							
		1 Aug 1 - Oct 31, 2021	2 Nov 1 - Jan 31, 2022	3 Feb 1 - Apr 30, 2022	4 May 1 - Jul 31, 2022	5 Aug 1 - Oct 31, 2022	6 Nov 1 - Jan 31, 2023	7 Feb 1 - Apr 30, 2023	8 May 1 - Jul 31, 2023
Kick-off Meeting	8/2/2021	X							
Task 0 - Project Management		X	X	X	X	X	X	X	X
Task 1 - Literature Review		X	X	X	X	X	X	X	X
Task 1 Report	1/31/2022		X						
Task 2 - Material Evaluation		X	X	X					
Task 2 Report	4/29/2022			X					
Intermediate Technical Panel Meeting	5/16/2022				X				
Task 3 - Application(s) Experimental Design					X	X	X		
Task 3 Report	1/6/2023						X		
Task 4 - Testing					X	X	X	X	
Task 4 Report	2/28/2023							X	
Task 5 - Analysis of Results and Reporting								X	X
Draft Final Report	3/31/2023							X	
Project Summary Report	5/15/2023								X
Performance Measures Report	5/15/2023								X
Project Poster	5/15/2023								X
Final Report	7/3/2023								X
Final Presentation and Webinar	7/17/2023								X
Implementation Meeting	7/17/2023								X
Implementation Report	7/31/2023								X

Any Questions?

Thank you!